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A new anophthalmic genus of Perigonini from the Iberian Peninsula

(Insecta, Coleoptera, Carabidae)

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Galiciotyphlotes weberi, gen. nov., spec. nov. is described from the Sierra de Ancares, north-west Spain. The anophthalmic and micropterous member of the Perigonini is characterised by a yellow-brown, depressed body, a fine suture separating tempus and gena, 2 supraorbital setae along the interior side of the sutures, ciliated shoulders and glabrous elytra each with 8 striae, series umbilicata complete (16 setae), internal sac of the aedeagus without pigmented parts, but with a group of meshes (similar to *Perigonillus*), and parameres without setae or only small remnants of them. The systematic position of the new genus is discussed, the habitat described, and biogeographical notes are given.

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Introduction

Many anophthalmic ground beetle species belonging to the Scaritinae, Trechinae, Bembidiinae, and Zuphiinae are distributed on the Iberian Peninsula. In the superficial underground compartment of the Sierra de Ancares (Lugo, Galicia), a specimen of a new genus is found well-characterised as a member of the tribe Perigonini. In spite of painstaking efforts, no further specimens have since been detected. Because of monotypy, it is difficult at present to separate the generic and species diagnosis. So the latter largely concerns the proportions.

Deposition of the type

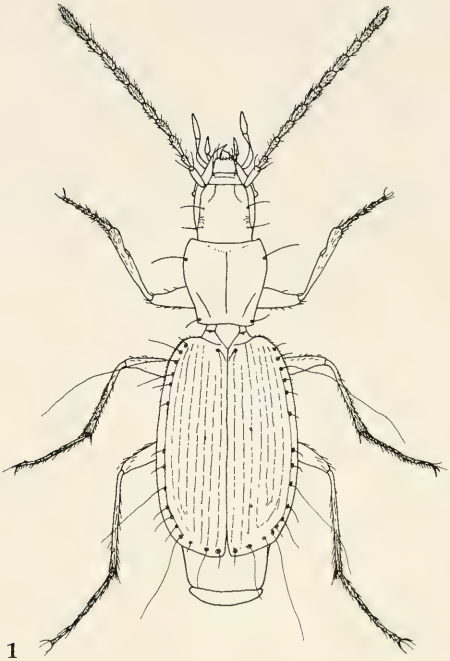
The holotype of the new species has been presented to the Zoologische Staatssammlung München, but is deposited as permanent loan in the collection of the author.

Galiciotyphlotes, gen. nov.

Figs 1-5a

Type species. *Galiciotyphlotes weberi*, spec. nov. by monotypy.

Diagnosis. Anophthalmic, micropterous, small-sized, depigmented, fore-body elongated, depressed (Figs 1, 2). Head with 2 pairs of supraorbital setae along the interior side of lateral sutures. Antennae long, pubescent from the second antennomere. Slightly dilated protarsi of male. Elytra glabrous, with



Figs 1-2. *Galiciotyphlotes weberi*, gen. nov., spec. nov. **1.** Habitus. **2.** Lateral view.

8 striae, and ciliated at the shoulder. Series umbilicata with 16 setae. Internal sac of the aedeagus without pigmented parts, but with a group of meshes. Parameres of the male genitalia without and with strongly reduced setae, respectively.

Description

The whole body yellow-brown coloured (incl. the appendices); microsculpture reticulated on the upper surface of the head, however composed of transverse lines and meshes on the pronotum, as well as on the elytra.

Head of medium size, elongated and parallel-sided, less constricted behind temporae; eyes seem to be completely absent; frontal furrows incomplete, only in the anterior third; tempus and gena separated from the frons and the vertex by a fine suture; 2 supraorbital setae along the interior side of these sutures; clypeus with 2 setae; labrum prolonged, anterior margin concave with 6 setae of which lateral longest, and sublateral small; mandibles feebly curved, comparatively short, not dentated; labial and maxillary palpi slender, penultimate segment of maxillary palpi shorter than the apical one and with narrow base, penultimate segment of labial palpi with 2 setae on the inner side, last segment of labial palpi conical (Fig. 3a); glossa with 2 setae; anterior margin of the mentum with a median tooth and a pair of setae, at the hind margin with 3 pairs of long setae, mentum and submentum/gula not separated by a suture (Fig. 3b); antennae long (about one-half of body length) and thin, from second antennomere onwards covered with hairs.

Pronotum strongly cordiform, its sides in the anterior half evenly rounded, posteriorly sinuated; 2 marginal setae, the anterior pair before the fore quarter, the posterior pair distinctly removed forward; fore angles pronounced (about 80°), hind angles bent upwards; lateral bead narrow; at the concave anterior border of the pronotum no margin; in the center of the disk a median sulcus

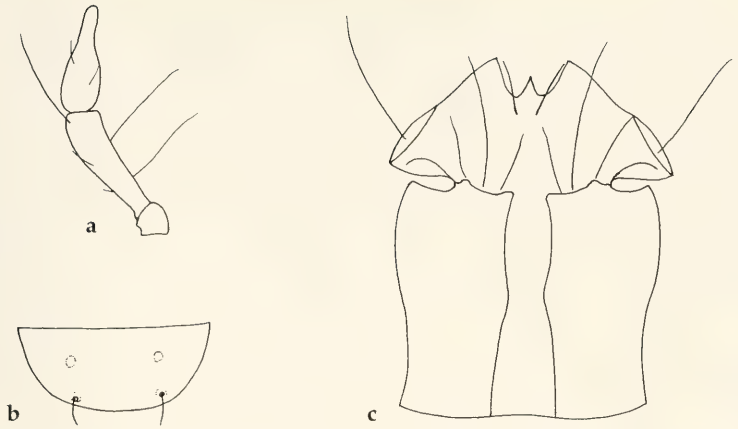


Fig. 3. *Galiciotyphlotes weberi*, gen. nov., spec. nov. Ventral surface. **a.** Labial palpus. **b.** Mentum, submentum, and glossa. **c.** Sternite VII.

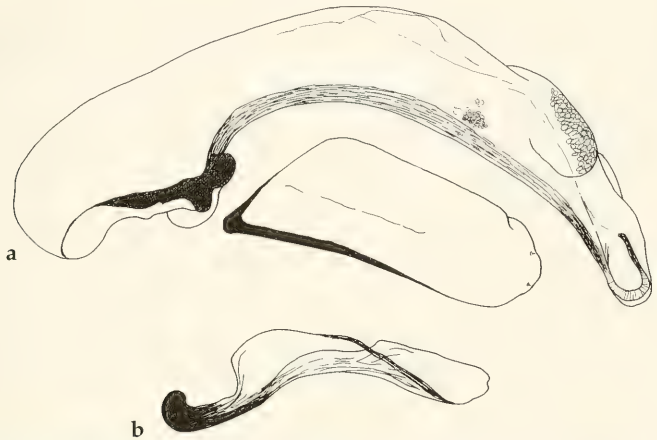


Fig. 4. *Galiciotyphlotes weberi*, gen. nov., spec. nov. ♂ genitalia. **a.** Aedeagus and left paramere. **b.** Right paramere.

developed, obsolete to the front and the base; 1 pair of pronotal foveae, without punctation and reduced to elongated impressions.

Elytra depressed, subparallel; shoulders rounded, prominent, and ciliated, not denticulated; epipleura simple; basal margin well developed and s-shaped; apex broad and somewhat truncated; 8 striae, not punctated, impressed, only in the apical parts interrupted, intervals flat; no recurrent part of the sutural stria; base of the first stria with a seta (scutellar seta), no scutellar stria; 3 discal setae near the third stria, the apical one small; 8th stria from the humeral group to the beginning of the apical group developed, in the apical part not discernible, at the end of the preapical group of the seria umbilicata a depression; umbilicate series complete (humeral group: setae 1-5, median group: setae 6-7, preapical group: setae 8-12, apical group: setae 13-16).

Metepisternum short, as long as wide at the anterior margin.

Abdominal sternites III to VII with 2 normal erect setae, not pubescent, with transverse microsculpture; sternite VII with an impression at the base of the setae and in front of them (Fig. 3c).

Legs long and slender; apical part of the tibiae pubescent and not distinctly grooved; first protarsal segment of male not and segments 2-4 only slightly dilated (Fig. 5a); the latter with adhesive setae on the lower side.

Male genitalia (Fig. 4). Aedeagus bent, apex rounded and with dark-brown pigmented cells forming a semicircle; internal sac without strongly pigmented parts (e.g. flagellum or ligula), but with

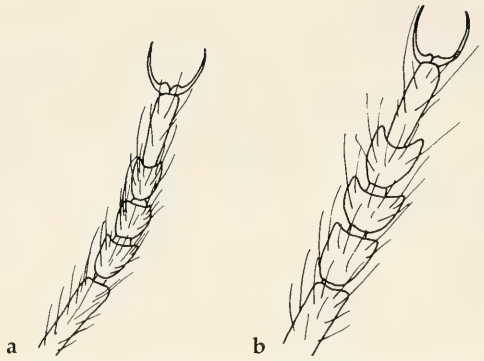


Fig. 5. Protarsi. **a.** *Galiciotyphlotes weberi*, gen. nov., spec. nov. **b.** *Typhlonestra elgonensis* Jeannel.

a group of well-recognisable meshes. Left paramere nearly parallel-sided, apex rounded; right paramere folded along the longitudinal axis, apex rounded. Two small remnants of setae at the posterior margin of the left paramere (visible only at strong magnification, 400 ×).

Etymology. Named from the region where the type species was found (Galicia) and from τυφλότης (typhlotes, blindness) due to the reduction of eyes.

Galiciotyphlotes weberi, spec. nov.

Figs 1-5a

Type. Holotype: ♂, NW-Spain, Lugo, Sierra de Ancares, Tres Obispos, 1300 m, 12.06.1997, leg. Th. Assmann.

Description

Body length from anterior margin of labrum to apex of elytra 4.1 mm. Head of medium size, 0.73 × as wide as pronotum. Antennae long, 0.51 × of body length; their scape 2.3 × as long as wide, 1.4 × as long as antennomere 2; the latter 1.8 × as long as wide; antennomere 3 as long as the 4th one and scarcely more slender; antennomeres 5-9 of similar length, but a little wider than the two previous ones; the ultimate antennomere 1.5 × as long as the penultimate one and 2.4 as long as wide. Pronotum nearly as long (in the middle) as wide; base 1.5 × as narrow as pronotal maximum; between the fore angles 1.1 × wider than between the posterior angles. Elytron about 1.7 × as long as wide and 2.6 × as long as pronotum (in the middle).

Distribution. Sierra de Ancares (Lugo, Galicia), north-western Iberian Peninsula. Known only from type locality.

Habits. The specimen was found on the lower side of a great stone within a dense *Ilex aquifolium* stand (other dominant species of the woodland are *Betula alba*, *Castanea sativa*, *Quercus pyrenaica*, *Erica arborea* and *Sorbus aucuparia*, for a more detailed description see Castro et al. 1997). For further information about the habitat see Discussion.

Etymology. This species is dedicated to the German carabidologist Friedrich Weber from the University of Münster, my doctoral supervisor, who introduced me to the study of ground beetles.

Discussion

Systematics

Basilewsky (1989) characterises the members of the tribe Perigonini (with particular consideration of African species) as follows: (1) 8th stria in the first half weakly developed, in the posterior part more pronounced, often forming together with the broad margin a parallel depression at the end of the

elytra; (2) the radial field of the elytra covered with short and dense hairs, whereas the elytra of most species are glabrous; (3) labrum with 6 setae; (4) 2 supraorbital and 2 prothoracal setae (for exceptions see Darlington 1968); (5) scutellar seta present, near the basis of the 2nd stria; (6) 3rd elytral interval with (in most species 3) setigerous small punctures; in some genera with additional punctures in the 5th and 7th interval; (7) the last dorsal puncture well removed from the hind margin of the elytra; (8) series umbilicata consists of 15 setae in 4 groups: humeral group (setae 1-5), median group (setae 6 and 7), preapical group (setae 8-10), and apical group (setae 11-15); in some genera the preapical and apical group are aggregated, in these cases a further seta is added between the two groups; (9) hind margin of the last visible abdominal sternite more or less bent or curved; in females margin in general finely and densely ciliated; a comparable pubescence lacking in males of many species (e.g. *Typhlonestra elgonensis* Jeannel, 1935); near the hind margin mostly 4 setae in males and 6-10 setae in females; (10) aedeagus only little differentiated, parameres without setae.

The characters (2)-(8) and (10) of this list are also realised in *Galiciotyphlotes*. In addition, other features referred to in the literature for the Perigonini have been detected in the new genus (e.g. penultimate segment of labial palpi with 2 setae on the inner side, epipleura simple, form of the palpi, cf. Jeannel 1942). Therefore the weak apical part of the 8th elytral stria, the development of the other striae on the elytra, and the deviant form of the abdominal sternite VII are the most important characters differing from other perigonine genera. The latter is extremely variable between the sexes within numerous species and between species of the same genus [e.g. *Euripogena congoana* (Burgeon, 1935), Basilewsky 1989], so it can only with restrictions be used as a character of the tribe. Moreover, the apical part of the 8th elytral stria is only slightly deepened in some genera (e.g. *Typhlonestra* Jeannel, 1935).

Galiciotyphlotes is similar to 2 Central African (and perhaps also South Asian) microphthalmic genera with 8th elytral stria deepened (at least slightly) towards the apex: *Typhlonestra* and *Perigonillus* Jeannel, 1935; this substantiates its assignation to the tribe. Numerous characters correspond: e.g. the overall habitus, the conical form of the last labial palpus segment, pronounced pronotal fore angles and upward bent pronotal hind angles with distinctly removed setae; short episternum of the metathorax; 16 setae in the series umbilicata; type of microsculpture on the surfaces of the head on the one hand and on the pronotum and the elytra on the other hand. The aedeagus of *Perigonillus* species shows a similar external form, only few strongly pigmented parts in the internal sac and a group of well-recognisable meshes.

The small, but pigmented eyes are a character of the genus *Perigonillus*. *Typhlonestra elgonensis* Jeannel, 1935 shows neither facets nor other cuticular structures of an eye. But in the ocular region a light brown spot in the anterior part of the cheek is recognisable ("une très petite aréole blanchâtre", Basilewsky 1989: 420). Similar spots located in the middle of the cheek are known from trechine beetles of the genus *Duvalius* (and from other ground beetles). Lamprecht & Weber (1979, 1982) observed that these so-called anophthalmic species are able to perceive light: in 12/12 hrs light/dark cycles locomotory activity was intensified by the signal "light on". Weber et al. (1996) detected in the ocular region of a *Duvalius* species with an oval pale spot a small eye cup, which contains rhabdomes with densely packed and highly ordered microvilli. It may be supposed that the similar spot of *Typhlonestra elgonensis* represents also a very regressive, nevertheless functioning eye.

Due to the exact description of *Perigonillus tonkinensis* by Silvestri, Basilewsky (1989) believed that this species is in fact a member of the genus *Typhlonestra*. The eyes of the species from Vietnam are composed of 10 pigmented ocelli. In *Galiciotyphlotes weberi*, ocelli as well as a lightened spot in the ocular region are not recognisable, meaning that this genus is (judging by its eyes) the most regressive one within the tribe.

Apart from the above-mentioned features, *Galiciotyphlotes* differs from the 2 African genera by slightly dilated protarsi (Fig. 5), depressed body, well-developed sutures on the head, and somewhat truncated elytral apex.

The genus *Galiciotyphlotes* combines plesiomorphic states (e.g. simple pattern of internal sac in the aedeagus, remnants of setae on the left paramere, simple chaetotaxy of the abdominal sternites, distinct striae on the elytra, shape of the 8th elytral stria) and apomorphic states (e.g. reduction of eyes and alae, fusion of the preapical and apical group of the series umbilicata). The apomorphic features are presumably related to an adaptation to the hypogeic habitat (regressive evolution of eyes and alae and progressive evolution by increasing the numbers of trichoid sensilla). Hence it may be supposed that *Galiciotyphlotes* is a member of an ancient lineage within the Perigonini. For a

more detailed analysis, a revision of the world Perigonini is necessary, as already demanded by Basilewsky (1989).

The new genus cannot be assigned to a supposed adelphotaxon* of the Perigonini: palpi not pubescent (in contrast to Omphreini and Lachnophorini); small body size, normal size of antennomere 1, only 2 pairs of pronotal marginal setae (in contrast to Omphreini); last and penultimate segment of maxillary palpus simple (in contrast to Lachnophorini); elytra glabrous, first antennomeres simple, dilated protarsi of male with normal adhesive setae (in contrast to Anchonoderini) (cf. Jeannel 1942).

Habitat. The soil type of the sampling site is an Atlantic Ranker with a deep AC profile on silicate rock (Franz 1979). Although the content of lime is poor in this rock stratum, many small crevices and cracks have developed in the C_1 horizon, which were described by Juberthie (1983) as habitat for many hypogeic species (superficial underground compartment or "milieu souterrain superficiel"). Franz (1979) was perhaps the first one to detect numerous anophthalmic and microphthalmic arthropods in this soil horizon of the Sierra de Ancares. Together with *Galiciotyphlotes weberi*, some beetles with reduced eyes have been found in the same habitat: the staphylinids *Domene gridellianum* Fagel, 1967, *Leptusa inexpectata* Fagel, 1967, *Leptusa asturiensis* Eppelsheim, 1880, *Leptusa scheerpeltzi franziana* Pace, 1981, the carabids *Trechus saxicola* Putzeys, 1870, *Reicheiodes microphthalmus* (Heyden, 1870) (cf. Balkenohl 1999), and the catopid *Speonomus vandalitae* Heyden, 1870. The list of epigeic carabids comprises 16 species, 11 of which are endemic for the north-western Iberian Peninsula: *Carabus lateralis* Chevrolat, 1840, *Carabus deyrollei* Gory, 1839, *Carabus amplipennis* Lapouge, 1924, *Leistus oopterus* Chaudoir, 1861, *Nebria galiciana* Jeanne, 1976, *Trechus gallaecus* Jeannel, 1921, *Argutor strenuus* (Panzer, 1797), *Melanius nigrita* (Paykull, 1790), *Haptoderus subiasi* Ortuño et Zaballos, 1992, *Haptoderus cantabricus* (Schaufuss, 1862), *Petrophilus brevipennis* (Chevrolat, 1840), *Oreophilus franzi* (Nègre, 1955), *Pterostichus cristatus* Dufour, 1820, *Anchomenidius astur* (Sharp, 1872), *Laemostenus oblongus* (Dejean, 1828), *Licinus aequatus* Serville, 1821 (for additional species see Novoa et al. 1989).

Biogeography

Due to the extremely low power of dispersal of endemic, anophthalmic and microphthalmic, hypogeic beetles, a long-lasting habitat continuity has to be postulated for the Sierra de Ancares. The glacial period had without any doubt decisively influenced the environment of hypogeic species. In regions of glacial permafrost soils the species are missing (e.g. in great parts of Central, West and North Europe: Holdhaus 1954, Franz & Beier 1970). They occur only in glacial refugia ("massifs de refuge") south of the Holdhaus borderline. In "older" vegetation maps for the last glacial period, tundra and steppe vegetation was postulated for the whole Iberian Peninsula (without the southern parts; e.g. Huntley & Birks 1983). New palynological results indicate also for the northern parts of Spain woodland refugia (Birks & Line 1993) and for the north-west of the peninsula (Galicia, Asturias) mixed woodlands and coniferous stands during the peak of glaciation (Castro et al. 1997). Therefore it has to be assumed that in this part of Spain the climatic conditions were also during the stadials mild and allowed a survival of hypogeic, anophthalmic beetles. In the rest of Spain (without the higher altitudes of mountains), the environmental conditions were so favourable that numerous anophthalmic carabid species survived (Fig. 6, cf. Franz 1963). The carabid fauna of the central Pyrenees which were heavily glaciated during the last glacial period seems to be depauperate, whereas in the regions which have never been glaciated the number of endemic and anophthalmic species is high (Assmann 1995). The differences between the massifs de refuge and the central parts are in the Pyrenees not as distinct as in the Alps with their "devastated" central region and the species-rich periphery (Holdhaus 1954). Further studies will show, if the greater areas without records of anophthalmic species in the north-west of the Iberian Peninsula are indeed not populated by such beetles or if they have not sufficiently been investigated up to now.

The tribe Perigonini has been recorded from Africa (without the north), southern Asia, Australia, Middle and South America (Basilewsky 1989). The only species known up to now from Europe is *Trechicus nigriceps* (Dejean, 1831) (often listed under the genus name *Perigona*), which comes originally from southern Asia, spread just during this century in Europe, and is capable of breeding in decaying

* It is not definitely known which tribe is the sister taxon of the Perigonini. The Anchonoderini are cited by some authors as Pterostichinae. Erwin (1985) includes the Perigonini and the Lachnophorini in the supertribe Lebiitae. For a detailed discussion of the systematic position of the Perigonini see Basilewsky (1989).

Fig. 6. Distribution of anophthalmic carabid genera on the Iberian Peninsula (incl. French parts of the Pyrenees) (modified after the data of Bonadona 1971, Sciaky 1989, Saldago-Costas 1993, Zaballos & Jeanne 1994). The genus *Parareicheia* is incorporated and the genus *Reicheia* Saulcy 1863 is excluded due to the characterisation of Jeannel (1957) as anophthalmic or microphthalmic, respectively (but see also Sciaky 1989). *Apoduvalius* is taken into account because the physiological function of the strongly reduced 'eye region' as a photoreceptor has not been proven. The taxonomy and the ranges of some genera are still subject to intensive research (e.g. Zaballos & Ruiz-Tapiador 1998), therefore the marked limits seem to be preliminary.

vegetation of nearly any kind (Jeannel 1942, Lindroth 1972, 1985, 1986). Erwin (1979: 591) characterises the members of this tribe as "tropically and warm-temperate adapted in all regions". If the ancestor of *Galiciotyphlotes* had a comparable temperature requirement, it may have arrived in Spain during a warmer climatic period (e.g. Pliocene or earlier). An adaptation to the changing climatic conditions (e.g. in the glacial period) has to be postulated (like for the Central African species *Typhlonestra elgonensis*, which lives in the alpine zone with *Senecio*-woodlands at about 3500 m at the Mount Elgon, and for the *Perigonillus* species exclusively found in higher altitudes of east African mountains). Therefore it may be supposed that the new genus is an ancient relict of a much wider distribution of the Perigonini.

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